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Indian Standard

TELEMETERING FOR CONSUMPTION AND DEMANDS

PART 1 IMPULSE TRANSMITTING AND RECEIVING DEVICES

ICS 33.200; 91.140.50

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

January 1998 **Price Group 3**

Equipment for Electric Energy Measurement and Load Control Sectional Committee, ET 13

FOREWORD

This Indian Standard (Part 1) was adopted by the Bureau of Indian Standards, after the draft finalized by the Equipment for Electric Energy Measurement and Load Control Sectional Committee had been approved by the Electrotechnical Division Council.

This part specifies the requirements for telemetering devices of impulse transmitting and receiving type for the purpose of consumption and demand, which are intended to operate along with electromechanical and static type electrical integrate meters.

This standard is based on the requirements outlined in Annex B hereof, and shall comprise another part as : Part 2 Digital Data Transfer. That other part shall be nothing but direct digital transfer of meter values.

This Standard is to be read with IS 722 (Part 1) : 1986 'Specification for ac electricity meters : Part 1 General requirements and tests (*third revision*)', IS 13010 : 1990 'ac watthour meters, class 0.5, 1.0 and 2.0,' IS 13779 : 1993 'ac static watthour meters, class 1 and 2' and CBI & P Report No. 88 (revision 1998) for ac static watthour meters, class 0.2S and 0.5S.

In the preparation of this standard, assistance has been derived from IEC Pub 338 (1970) 'Telemetering for consumption and demand' issued by International Electrotechnical Commission.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value shall be the same as that of the specified value in this standard.

Indian Standard

TELEMETERING FOR CONSUMPTION AND DEMAND

PART 1 IMPULSE TRANSMITTING AND RECEIVING DEVICES

1 SCOPE

1.1 This standard applies to telemetering apparatus, intended to operate in conjunction with electrical integrating meters (static and electrotechnical type) in particular for billing and statistical purpose.

1.2 This standard covers telemetering apparatus consisting of :

a) an impulse device that causes emission of impulse signals from a set of output terminals whose number is proportional to the integrated quantity of electrical parameter(s) as measured from the test output of the static meter or from number of revolutions of rotor of the electromechanical meter.

b) devices for receiving such impulses, converting them into analogous or digital values, and displaying the values which represent the integrated quantity, for example, the energy, active or reactive, or the mean power measured during a fixed period of time or at least 10 min, and

c) device totalizing or otherwise evaluating the impulse signals from several meters by arithmetical or algebraic operations.

1.3 This standard is applicable regardless of the distance between impulse meter and receiver.

NOTE — Besides the need to transmit metering quantities over long distance, there are many applications where the receiving devices are located quite near the meter.

1.4 This standard does not apply to :

a) system transmitting in an analog from the instantaneous rotor speed or any other quantity proportional to the power, for example by means of a current or a voltage corresponding to this power;

b) systems transmitting occasionally or periodically the readings of the register of an integrating meter, for example, by scanning either the combinations of switches or marking by magnetic or optical means; and

c) system employing direct digital, serial or parallel data transfer with communication part or static electricity meters. Refer Annex B.

1.5 This standard does not cover the channels for transmitting the impulses from the transmitting to the receiving end, for example, telephone lines, low or high frequency communication, since these channels should comply with other appropriate documents.

1.5.1 Converting the modulating units, made necessary by the properties of the transmitting channels, may be covered by this standard only if they form an integral part of the telemetering apparatus.

2 REFERENCES

2.0 The Indian Standards given in Annex A are necessary adjuncts to this standard.

3 DEFINITIONS

3.0 For the purpose of this standard, the following definitions shall apply.

3.1 Supporting Meter

An integrating meter to which it is intended to incorporate the impulse device, for example, single phase or static meters (*see* IS 13010, IS 13779 and CBI & P Report No. 88-Revision July 1996).

3.2 Impulse

An element of a signal : characterized by a sudden change in the value of a quantity, followed by a sudden return to the original state, for example, voltage, current, frequency, impedance.

3.3 Impulse Device

A device which produces at a set of output terminals, a fixed number of electrical impulses, integral or fractional corresponding to unit integrated quantity of electrical parameter(s) as measured from test output of the static meter or to each revolution of rotor of the electromechanical meter.

3.4 Impulse Meter

The combination of an integrating meter and an impulse device whether integral or separate.

3.5 Impulse Frequency

The number of impulses per time unit, for example, number of impulses per minute.

3.6 Impulse Amplifier

A device used to increase the level of voltage or current impulses produced by the impluse device.

3.7 Impulse Shaper

A device designed to alter the shape, duration, level phase, or polarity of voltage or current impulse originating from the impulse device or impulse amplifier.

3.8 Impulse Frequency Changer

A device changing the impulse frequency in a definite ratio.

3.9 Receiver

Apparatus comprising a device for receiving impulses, with or without an information processing device and an output device such as integrating register, demand register, a recording and/or storage device, a pointer, a recorder or a device for recording on punched or magnetic tape.

3.10 Mechanical Receiving Device

A device which transforms the incoming impulses mechanically into an analogous quantity or digital value.

3.11 Electric Receiving Device

A device which receives and stores the impulses in electronic or magnetic arrangements without the use of magnetic relays.

3.12 Demand Integration Period

The nominal duration of the consecutive equal intervals of time (for example, 10, 15, 30 and 60 min), which comprises the time during which the integral values of electrical energy parameter(s) are computed and stored in demand register(s) for electromechanical meters, it is the time during which the driving element of the maximum demand indicator is coupled to the receiving device, and the detent time (*see* IS 8530).

3.13 Detent Time (for Electromechanical Meter)

The interval of time at the end, but within each demand integration period, during which the disconnecting element releases the coupling between the maximum demand indicator and the receiving device to allow the driving element to be restored to its initial position.

4 CLASSIFICATION

4.1 Classification of Apparatus

4.1.1 *Mechanical Impulse Device*

A device in which the electrical impulse is set up by the uniting and parting of metal contacts.

4.1.1.1 This category included element generally employing:

a) all types of contacts operated directly or by permanent magnet;
b) interchangeable gear trains which allow the number of impulses per revolution of the meter rotor to be changed; and
c) facilities whereby the mechanical burden is spread by means of weight or springs.

4.1.1.2 This category is characterized by the fact that the mechanical burden these devices impose on the meter is not negligible. On the other hand, they do not usually necessitate electrical amplification.

4.1.2 *Servo-Mechanical Impulse Device*

A device which is substantially the same as the one if **4.1.1** but with the addition of servo-assistance or servo-operation which permits a reduction of the mechanical burden. It embodies relays or motors and their control devices.

4.1.3 *Non-mechanical Impulse Device*

A device in which the burden imposed on the supporting meter is reduced to that required to operate the undermentioned elements and their associated gearing, if any.

4.1.3.1 This category includes elements generally employing:

a) photo-cell or photo-diode controlled by variation of the intensity of illumination;
b) oscillating circuit controlled by variation of an inductance or a capacitance;
c) semiconductors controlled by variation of a magnetic field; and
d) other forms of electronic driving circuit.

4.1.4 *Receiver without Amplifier*

A receiver (*see* **3.9**) in which the incoming impulses directly operate the output device, if necessary after storage.

4.1.5 *Receiver with Mechanical Amplifier*

A receiver (*see* **3.9**) in which the incoming impulse operate a relay which permits a motor-driven shaft to rotate through a certain angle for each impulse received.

4.1.6 *Receiver with Electrical Amplifier*

A receiver (*see* **3.9**) in which the incoming impulses are electrically amplified before operating the output device by means of, for example, a relay mechanical storage, or an electronic memory device.

4.1.7 *Scanning Device*

A device to ascertain by periodic scanning, if there has been any change in the state of either the impulse device or subsequent states relating to a number of impulse meters. This scanning is effected for a period of specified duration, each change of state corresponding to a specified consumption.

4.2 Classification of Impulses (*see* 3.2)

4.2.1 *Uni-Directional Impulses*

Impulses following each in such a manner that the change in the value of the quantity in relation to the initial value is always of the same sign or magnitude.

4.2.2 *Bi-Directional Impulses*

Impulses following each other in such a manner that the change in the value of the quantity in relation to the initial value changes its sign for each connective impulse.

4.2.3 *Momentary Impulses*

Impulses, the duration of which is independent of the input power.

5 STANDARD VALUES

5.1 Rated Supply Voltage

Standard values for rated supply voltages to impulse transmitting and receiving devices are :

a) for ac : 57.7; 63.5; 100; 110; 230; 240 V; and
b) for dc : 6; 12; 24; 30; 48; 60; 110; 220 V.

5.2 Demand Integration Period

Standard values of demand integration period are:

10; 15; 30; 60 min.

5.3 Rated Supply Frequencies

Standard supply frequency shall be 50 Hz.

6 ACCURACY

6.1 The requirements relating to accuracy shall be fulfilled under reference conditions of voltage, frequency, and temperature, and with balanced load in the case of polyphase meters.

6.2 The accuracy of a telemetering system is determined as follows.

6.2.1 The error of the impulse meter. This error shall not exceed the limits fixed for the class of the supporting meter in the corresponding Indian Standard.

6.2.1.1 The variation in the error of the impulse meter due to disconnection of the impulse device shall not exceed the value given in Table 1 at 5 percent of basic current and at unity power factor.

Table 1 Variation in Errors of the Impulse Meter

(*Clause* 6.2.1.1)

Meter Class	Polyphase	Single-phase
0.5 and 1.0	1 percent	2 percent
2.0 and 3.0	2 percent	4 percent

6.2.1.2 The impulse meter shall start and continue to function in accordance with the requirements for the supporting meter, but the following increase of tolerance for the limit of starting current of the respective meter shall be permitted :

a) 0.2 percent of basic current for non-mechanical devices; and
b) 0.5 percent of basic current for mechanical devices.

6.2.2 *The Error Due to the Connection Between the Meter Rotor and the Impulse Device (for Electromechanical Meters only)*

Since no slip whatsoever is permitted, the average value of this error for any complete cycle of the impulse meter shall be zero.

6.2.3 *The Error Inherent in Impulse Metering*

This error is due to the fact that it is a discontinuous process in which the maximum value of cycle uncertainity is always one impulse.

6.2.3.1 The number N of impulses per integration period is related to the value of the uncertainity u. For a given value of the uncertainity u the number N is given by the formula :

$$N = \frac{100}{u} \text{ impulses/period, and}$$

u expressed as a percentage.

6.2.3.2 If the duration of a integration period is T min, the impulse frequency f for a given value of u is given by the formula :

$$f = \frac{N}{T} = \frac{100}{u \, . \, T} \text{ impulses/min}$$

NOTE — If a large number of successive measurements is considered in telemetering, 50 percent of these measurements have an uncertainity which is only 0.3 u or less.

6.2.3.3 The duration of the integration periods for demand measurements being relatively short, it is this which governs the impulse frequency rather than the much longer period for measuring consumption.

6.2.3.4 The constant R representing the number of impulses per kilowatthour is given by the formula:

$$R = \frac{60}{P} \, . \, \frac{100}{u \, . \, T} \text{ impulses per kilowatthour,}$$

where P = Power in kW

Thus uncertainity $u = \frac{60}{p} \cdot \frac{100}{R.T}$

6.2.3.5 In order to obtain a reasonable accuracy of the telemetering system for the measurements of the average power, the relation between the class of supporting meter and the maximum uncertainity u at 30 percent rated maximum current and unity power factor for single-phase and polyphase meter shall be as shown in Table 2.

Table 2 Uncertainity

Meter Class	Uncertainity u
0.5	0.3
1.0	0.6
2.0	1.2
3.0	1.8

6.2.4 *The Intrinsic Error of the Receiving Device Together with Operated Maximum Demand Indicator, If Any (For Electromechanical Meters Only)*

This error shall be within ±0.5 percent of its rating.

6.3 For consumption measurements, it is easy in most cases to obtain a much smaller uncertainity. The permissible uncertainity may be fixed between the contracting parties.

6.4 The impulse device and the receiver shall be so designed that they operate without fault throughout the entire range up to maximum input power level up to its maximum value when the voltage circuit of the supporting meter is supplied at its maximum voltage. While functioning, they shall not be disturbed by the effect of the supply voltage of the impulse device when it varies within the following limits:

a) For ac : 80 to 115 percent of rated voltage; and
b) For dc : 80 to 110 percent of rated voltage.

6.4.1 In the same way, the functioning of the apparatus shall not be disturbed by variation in other influence quantities provided these later remain within the limits defined for each of them in the Indian Standard pertaining to the supporting meter.

6.5 Where impulses are received from several impulse meters, then in devices involving stored impulses the frequency of scanning shall be at least 20 percent above the highest impulse frequency of any of the impulse meters.

6.6 If the transmission of impulses ceases because, for example, by cutting of the supply to the impulses device or to the receiver or because of damage to them, the errors of the impulse meter should not exceed the values mentioned in **5.2**.

7 GENERAL REQUIREMENTS

7.1 If the receiver includes a maximum demand indicator, there shall be a register for consumption, or other means enabling the registration of the receiver to be verified.

7.2 If the receiver includes a maximum demand recorder, provision shall be made for the storage of impulses during the detent time, where applicable.

7.3 If there is a risk of interruption in the supply voltage, the storage and other devices shall be designed so that the information of the integrated value within the integration period shall not be lost.

7.4 A reversal-preventing device shall be provided if there is a possibility that by reversal of the direction of power the impulse meter rotor might rotate for electromechanical meters in a reverse direction. This device shall be so designed that false impulse cannot occur as a result of partial reversal of the rotor.

7.5 The impulse meter and the receiver shall be so constructed as to operate correctly under ordinary conditions of service.

7.6 The entire telemetering apparatus and the transmission channel shall be co-ordinated so that the production of incorrect impulses is avoided and correct impulses are not suppressed.

7.7 The impulse output from the meter shall be in the form of potential free contacts. The contact voltage and current rating shall be as per the requirement of the receiver for example 240 V 1 Amp (non-inductive).

8 SAFETY REQUIREMENTS

8.1 Impulse meters and receiving devices shall be so constructed as not to introduce any danger in normal use and under normal conditions.

8.1.1 That portion of the impulses meter terminal block which is provided for the external connections shall be constructed with clearances and creepage distances not less than those specified in Table 3.

Table 3 Clearance and Creepage Distances

Sl No	Voltage, V	Clearance mm	Creepage Distance mm
(1)	(2)	(3)	(4)
i)	Up to and including 25	1	1
ii)	26 to 60	2	2
iii)	61 to 250	3	3
iv)	251 to 450	3	4
v)	451 to 600	4	6

8.2 When hand-operated resetting devices are used, for example, in maximum demand indicators, additional precautions against electric shock are required. Protective covers, if any, shall not be removable without the use of an appropriate tool.

8.3 Dielectric Tests

8.3.1 *Impulse Voltage Test*

All circuits in the telemetering apparatus which are intended to be directly connected to the mains shall be subjected to the following impulse voltage test of ten applications of 1.2/50 micro second impulses of the same polarity [*see* the relevant sub-clauses of IS 2071 (Part 2)] and in accordance with relevant standards of supporting meters:

Test Voltage (Peak Value)	*Test Voltage to be Applied Between*
6 kV	a) All current and voltage circuits connected together; and
	b) The frame of the apparatus or the flat metal surface connected to the frame, if the apparatus has a moulded insulation base.

8.3.1.1 The tests shall be made only on completed apparatus and not on unassembled components and carried out once only. No flashover and no damage shall occur and after this test the apparatus shall withstand all ac voltage tests prescribed in **8.3.2**.

8.3.2 *ac Voltage Test*

All circuits in the telemetering apparatus which are intended to be directly connected to the mains shall withstand the respective ac voltage tests laid down in the relevant standards for meters. When there is a hand-operated resetting device, indicated in **7.2**, the high voltage test is carried out when the hand-operated control is in contact with the internal mechanisms of the meter.

9 MARKING OF IMPULSE METERS AND RECEIVERS

9.1 Each impulse meter shall bear the following information in addition to that required by relevant standards for supporting meters:

a) The constant *R* for example, impulse/kWh (*see* **6.2.3**),
b) Contact rating of impulse device (*see* **6.6**), and
c) No/NC and type of output contacts.

9.2 The receiver shall bear the following information:

a) Manufacturer's name or trade-mark, and if required, the place of manufacture;
b) Designation or type;
c) Serial number and year of manufacture;
d) Rated supply voltage and frequency;
e) The principle units in which the register records (for example, kWh) and constant *R*; and
f) In the case of maximum demand indicator: the constant *K* the demand integration period, in minutes; and the detent time for electromechanical type meters.

9.3 The telemetering apparatus may also be marked with the Standard Mark.

9.3.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Clause* 2.0)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
722 (Part 1) : 1986	ac Electricity meters : Part 1 General requirements and tests (*third revision*)
2071 (Part 2) : 1974	Test procedures (*first revision*)
8530 : 1977	Maximum demands indicator (class 1)
13010 : 1990	ac Watthours meters, class 0.5, 1 and 2
13779 : 1993	ac Static watthour meters, class 1 and 2

ANNEX B

(*Foreword*)

TELEMETERING SYSTEM

B-1 The Part 1 of this standard based on the IEC 338-1970, is applicable to the conventional telemetering system that utilises activated switching contacts of impulsing devices in conjunction with electromechanical/static meters for transfer of incremental meter values to local/ remote electromechanical/static receivers via a transmission channel with or without intermediate summation/ subtraction/integration of such incremental meter values. While such devices are still in use in large numbers certain limitations of such impulsing devices like electromechanical relays or semiconductors for the sake of transfer of incremental meter value, may be borne in mind.

B-2 The limitations observed with electromechanical meters with impulsing devices are as given hereunder.

B-2.1 These devices have an inherent uncertainity error as discussed in **6.2.3** of this standard. This resolution uncertainity is limited by the maximum response rate that can be achieved by conventional electromechanical contacts.

B-2.2 The limited resolution of impulsing devices lead to measurement inaccuracies for example in applications involving concurrent kVA demand computation from multiple meters, under varying power factor conditions.

B-2.3 These devices also suffer from contact bounce, improper contact and distortion problem, information (EG, active import, reactive leg, etc) per meter.

B-2.4 Conventional transfer of incremental meter values can only support one parameter informtion (EG, active import, reactive, leg, etc) per meter.

B-3 The new generation of static meters, employing improved impulsing techniques with rapid switching contacts of semiconductor devices, have overcome to some extent, few of the problems mentioned in **B-2** above. They are fast, less uncertain and more dependable. Besides, they can support multiple parameter information per meter. However, they do not reap the full benefit of the static metering technology.

B-4 A number of manufacturers have now come out with more efficient telemetering apparatus employing direct digital transfer of original meter values by utilising communication interfaces to overcome the inherent limitations of the conventional transfer of incremental meter values by impulsing devices and to provide improved performance with advanced features.

B-4.1 Multiple parameter information can not only be supported by a single supporting meter, but only a single transfer channel is sufficient.

B-4.2 Effective reliability can be achieved with commensurate accuracy single transfer of meter value is direct and original.

B-4.3 This technology can be gainfully used to detect data integrity and take corrective actions in case of temporary loss of data link.

B-5 Telemetering system that utilises static meters for direct digital transfer of original meter values employing communication interfaces, will be dealt within Part 2 of this standard, now under preparation.

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